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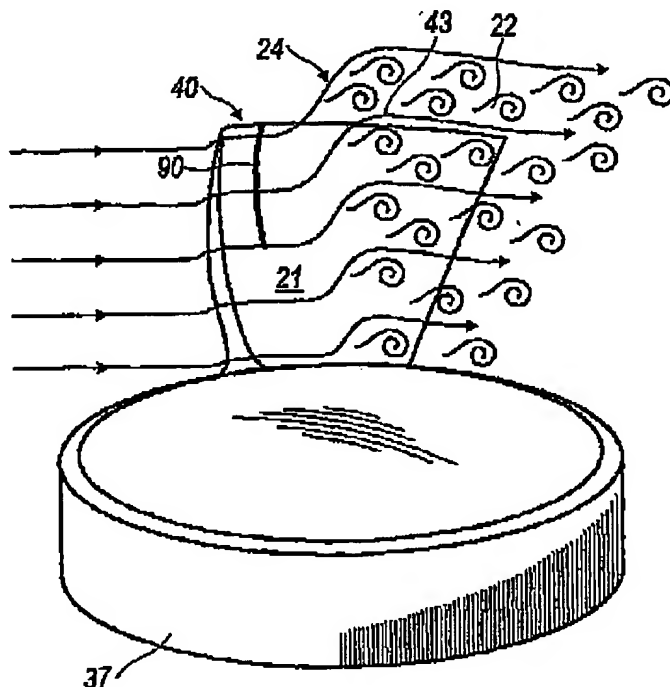
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(54) Title: MITIGATION OF UNSTEADY PEAK FAN BLADE AND DISC STRESSES IN TURBOFAN ENGINES



(57) Abstract: Method and apparatus for providing a turbofan blade (40) adapted to initiate and control a boundary layer transition at a side surface of the blade (40) during operation as a component in a turbofan assembly (35). The turbofan blade (40) includes a leading edge (55), a trailing edge (58), and two side surfaces including a high-pressure side surface (49) and a low-pressure side surface (52). At least one of the two side surfaces has an essentially smooth surface portion (61) located between the leading and trailing edges, and the essentially smooth surface portion is interrupted by a surface deviation (64). The surface deviation is configured to fix a positionally unstable laminar to turbulent boundary layer transition (24) at a location toward the trailing edge from the surface deviation during operation of the turbofan blade in the turbofan assembly. In this manner, fatigue inducing and/or structurally damaging unsteady aerodynamic forces experienced upon the blade and/or fan disc during operation are controlled, and the resultant fluctuating fan blade and disc peak stresses are mitigated.

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## A. CLASSIFICATION OF SUBJECT MATTER

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USPC: 416/236R, 229R, 230, 241R, 1, 61; 415/914, 118

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,313,700 A (DORMAN) May 24 1994, Fig. 1.	1-5, 8-14, 16-41, 43-45, and 47-49
Y	US 5,169,290 A (CHOU) December 8 1992, Figs. 1-4D.	1-5, 8-14, 116, 17, 18-41, 43-45, and 47-49
Y	US 6,416,289 B1 (RAMBISH et al.) July 9, 2002, Fig. 6.	1-5, 8-13, 18-39, 41, 43, and 44
Y	US 1,903,823 A (LOUGHEED) April 18, 1933, Figs. 1-19.	1-5, 8-13, and 18-40

☐ Further documents are listed in the continuation of Box C.☐ See patent family annex.

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